

# PATENT COOPERATION TREATY

From the  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

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## PCT NOTIFICATION OF TRANSMITTAL OF INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

Date of Mailing  
(day/month/year) **10 FEB 2005**

Applicant's or agent's file reference

P56907-INT

### IMPORTANT NOTIFICATION

International application No.

PCT/US03/37086

International filing date (day/month/year)

11 December 2003 (11.12.2003)

Priority date (day/month/year)

12 July 2002 (12.07.2002)

Applicant

JAISINGHANI, RAJAN A.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.
4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices)(Article 39(1))(see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/US

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# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference  P56907-INT	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No.  PCT/US03/37086	International filing date ( <i>day/month/year</i> )  11 December 2003 (11.12.2003)	Priority date ( <i>day/month/year</i> )  12 July 2002 (12.07.2002)
International Patent Classification (IPC) or national classification and IPC  IPC(7): B03C 3/155 and US Cl.: 96/67		
Applicant  JAISINGHANI, RAJAN A.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

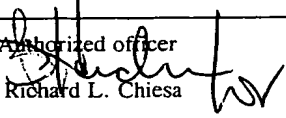
2. This REPORT consists of a total of 2 sheets, including this cover sheet.

☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 5 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of report with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand  09 September 2004 (09.09.2004)	Date of completion of this report  27 January 2005 (27.01.2005)
Name and mailing address of the IPEA/US Mail Stop PCT, Attn: IPEA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703) 305-3230	Authorized officer  Richard L. Chiesa Telephone No. (571) 272-1700

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US03/37086

**I. Basis of the report****1. With regard to the elements of the international application:\***

- ☐ the international application as originally filed.
- ☒ the description:  
pages 1-34 as originally filed  
pages NONE, filed with the demand  
pages NONE, filed with the letter of \_\_\_\_\_.
- ☒ the claims:  
pages 35-36, as originally filed  
pages NONE, as amended (together with any statement) under Article 19  
pages NONE, filed with the demand  
pages 37-40, filed with the letter of 03 January 2005 (03.01.2005)
- ☒ the drawings:  
pages 1-23, as originally filed  
pages NONE, filed with the demand  
pages NONE, filed with the letter of \_\_\_\_\_.
- ☐ the sequence listing part of the description:  
pages NONE, as originally filed  
pages NONE, filed with the demand  
pages NONE, filed with the letter of \_\_\_\_\_.

**2. With regard to the language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language \_\_\_\_\_ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

**3. With regard to any nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in printed form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

**4. ☒ The amendments have resulted in the cancellation of:**

- ☒ the description, pages NONE
- ☒ the claims, Nos. NONE
- ☒ the drawings, sheets/fig NONE

**5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).\*\***

\* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

\*\* Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.  
PCT/US03/37086**V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement****1. STATEMENT**

Novelty (N)	Claims <u>1-24</u>	YES
	Claims <u>NONE</u>	NO
Inventive Step (IS)	Claims <u>NONE</u>	YES
	Claims <u>1-24</u>	NO
Industrial Applicability (IA)	Claims <u>1-24</u>	YES
	Claims <u>NONE</u>	NO

**2. CITATIONS AND EXPLANATIONS**

Claims 1-24 lack an inventive step under PCT Article 33(3) as being obvious over Jaisinghani in view of Carr. Jaisinghani (note figures 1-8) shows an electrically enhanced filter apparatus and method of making it substantially as claimed. It would appear that Jaisinghani may not explicitly disclose the presence of first and second electrically conducting grids covering first and second major exteriors of the filter medium. In any case, Carr (note reference characters 26, 28, figures 1-5) teaches the use of electrically conducting grids covering the major exteriors of the filter medium in an electrically enhanced filter apparatus for the purpose of ensuring foreign particle capture (note column 3, lines 34-37). Consequently, it would have been obvious to one having ordinary skill in the art to employ electrically conducting grids covering major portions of the filter medium in the Jaisinghani electrically enhanced filter apparatus and method of making it in order to facilitate the capture and removal of unwanted particles in the air stream as taught by Carr. Contrary to applicant's remarks, both Jaisinghani (note reference character 314, figure 3B) and Carr (note reference character 30, figure 4) show pockets formed by the zig-zag arrangement of the pleated filter mediums just as in applicant's filter device.

Claims 1-24 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in the air pollution control industry.

PCT/US03/37086.03012005

IPEA/US 03 JAN 2005

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connecting said second grid to said local reference potential.

11. A filter for an electrically enhanced filtering apparatus, comprising:  
a layer of a porous filter medium folded into one or more arms forming a pocket with a terminus of said pocket located on a downstream side of said medium and  
5 with a base of said pocket open to an upstream side of said apparatus;

a first electrically conducting, perforated grid disposed on an exterior of said medium to cover said downstream side of each of said arms; and

a second electrically conducting, perforated grid electrically separated from said first grid by at least said medium, disposed in geometric conformity to the exterior of each of said arms on an upstream side of said medium, to maintain electrical isolation of said second grid and to allow disposition of said filter to accommodate passage of at least one electrode through said pocket while the electrode is positioned between said terminus and said base, with said second grid spaced-apart from the electrode.

12. The filter of claim 11, comprised of said base exhibiting a linear dimension  
15 greater than said thickness.

13. The filter of claim 11, comprised of a distance between said base and said terminus being greater than or equal to a linear dimension exhibited by said base.

14. The filter of claim 11, comprised of a distance between said base and said terminus being not less than a linear dimension exhibited by said base, and said linear  
20 dimension being greater than a thickness exhibited by said medium.

15. A filter for an electrically enhanced filtering apparatus, comprising:  
a layer of a porous filter medium folded into one or more arms forming a pocket with a terminus of said pocket located on a downstream side of said medium and  
with a base of said pocket open to an upstream side of said apparatus;

25 a first electrically conducting, perforated grid disposed on an exterior of said medium to cover said downstream side of each of said arms;

a second electrically conducting, perforated grid electrically separated from

said first grid by at least said medium, disposed in geometric conformity to the exterior of each of said arms on an upstream side of said medium;

an air inlet; and

an electrode spaced-apart from said second grid, positioned between said arms to extend across said air inlet.

16. The filter of claim 11, with said layer further comprised of:

said layer disposed in a plurality of pleats within each of said arms, with said pleats undulating between said first grid and said second grid.

17. The filter of claim 11, comprised of said layer extending along each of said arms in an elongate linear continuum lying between said first grid and said second grid.

18. The filter of claim 11, further comprised of:

said layer extending along each of said arms in a linear continuum lying between said first grid and said second grid; and

an electrical insulator maintaining one of said first grid or said second grid physically spaced-apart from said medium.

19. The filter of claim 11, further comprising at least one of said first grid and said second grid being made of a material selected from a group comprised of carbon, carbon fibers, fibers coated with carbon, and combinations of at least two of carbon, carbon fibers, and fibers coated with carbon, printed upon at least one of said first major exterior and said second major exterior of said medium.

20. The filter of claim 11, comprised of said second grid comprising a material porous to passage of gaseous fluid through said apparatus but partially impervious to particles borne by the gaseous fluid.

21. A filter for an electrically enhanced filtering apparatus, comprising:

a layer of a porous filter medium folded into one or more arms forming a pocket with a terminus of said pocket located on a downstream side of said medium and

with a base of said pocket open to an upstream side of said apparatus;

a first electrically conducting, perforated grid disposed on an exterior of a downstream side of each of said arms; and

a second electrically conducting, perforated grid electrically separated from said first grid by at least said medium, disposed in geometric conformity to the exterior of an upstream side of each of said arms, to permit joindure of said filter and the apparatus while maintaining electrical isolation of said second grid and to position said arms on opposite sides of at least one electrode and allow the electrode to extend through said pocket with the electrode located between said terminus and said base while spaced-apart from said second grid.

22. A process of making a filter for an electrically enhanced filtering apparatus, comprised of:

folding a layer of a porous filter medium into one or more arms forming a pocket with a terminus of said pocket located on a downstream side of said medium and with a base of said pocket open to an upstream side of said apparatus;

disposing a first electrically conducting, perforated grid on an exterior of a downstream side of each of said arms; and

disposing a second electrically conducting, perforated grid in electrical separation from said first grid in geometric conformity to the exterior of an upstream side of each of said arms to permit joindure of said filter and the apparatus with said arms positioned on opposite sides of at least one electrode to allow the electrode to extend through said pocket with the electrode located between said terminus and said base while the elctrode maintained during the joindure in electrical separation from said second grid.

23. The process of claim 22, further comprised of selecting at least one of said first grid and said second grid from a group comprised of carbon, carbon fibers, fibers coated with carbon, and combinations of at least two of carbon, carbon fibers, and fibers coated with carbon, printed upon at least one of said first major exterior and said second major exterior of said medium.

24. The process of claim 22, comprised of making said second grid from a

PCT/US03/37086 .03012005

IPEA/US 03 JAN 2005

material porous to passage of gaseous fluid through said apparatus but partially impervious to particles borne by the gaseous fluid.



**ABSTRACT**

A method and apparatus using deep pleated filters to provide efficient and safe electrically enhanced filtering (EEF), with ultra low pressure drop, higher efficiency of particulate removal and higher dirt holding capacity over the life of the filter. An EEF may be constructed with a housing, with or without an internal air moving device such as a fan, a deeply pleated filter, preferably a V-pack filter with sets of downstream ground electrodes and charge transfer electrodes borne by the exterior surface of the filter packs that form the filtering element. An ionizer assembly that ionizes the gas and charges particles entering the deeply pleated filter and also transfers a charge to the charge transfer electrodes on the filter pack. A plate seals the gasket on the filtering element against the ionizing assembly. A high electrical potential is applied to charging elements in the ionizer and, in some embodiments, a fan or motor assembly. The charge transfer electrodes enable the device to function with a high particle collection field between the charge transfer electrodes and the downstream grounded electrodes to safely and efficiently attain higher entrapment of the particles on the filter medium.